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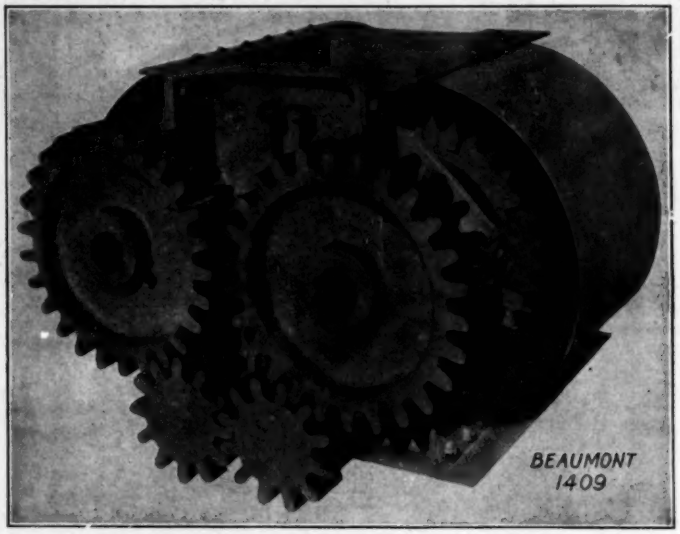

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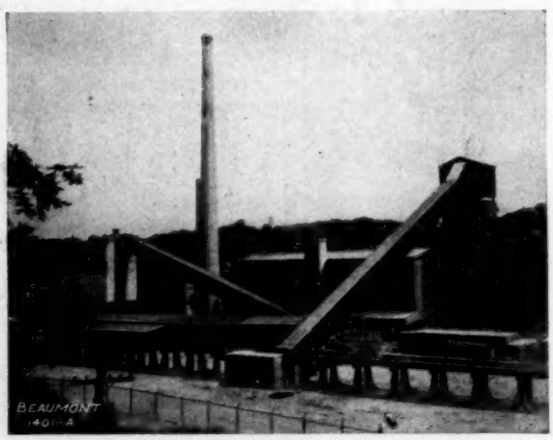

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Going in for the Production of By-products Linked with Many Important Considerations

Yet It Is a Development that Cannot be Neglected Even by the Small Gas Works—Various of the Considerations Involved

By L. W. ALWYN-SCHMIDT
Research Department, New York Economic Service Bureau, New York City

The great demand for the by-products of the gas industry makes necessary an intimate study of all the aspects of this new source of income to our gas works. It is especially essential that it should be clearly established which form of producing by-products is the most advantageous for the individual enterprise, and which of the great range of by-products holds the best promise for a permanent market.

Erecting a by-product plant is a very expensive matter at the best, and there are few gas works which can stand the given expenditure for purely experimental purposes.

Often a Risky Undertaking

Experience also has shown that the production of by-products is often a risky matter owing to the considerable variations in the sales price of these products, which may easily make unprofitable a large investment in a by-product installation.

Also there is always with us the danger of an overproduction of certain by-products, resulting in an unhealthy decline of the price of the product all over the market.

The decision of what form the installation is to take must be always one for the engineers and chemists.

There are very few by-products which can be produced without the permanent aid of chemists, and the employment of a large staff of experts forms by itself a considerable expenditure which cannot be lightly undertaken.

The selection of the product which it is desired to produce, however, should be made by the commercial staff of the enterprise, after a complete investigation of the possibilities of each product and its special fitness for the technical and economic conditions of the plant.

This article is written with a view to assist in the solution of the economic problems involved.

Selecting the By-product to Produce

In selecting a suitable by-product for manufacturing by a gas works in each case the following two tests should be applied:

(1) Which of the possible products can be produced most conveniently and at the most reasonable cost to the plant?

(2) Which of those answering the first test holds the best promise for a permanent market with the least variation in price?

Being concerned mostly with the second part of the study we can proceed immediately to its further consideration.

Hardly any of the by-products of the gas industry of to-day are direct materials. Most of those, in fact, which were added more recently to the list of by-products are the basic materials or supplementary materials used by other industries.

The dyestuffs industry, the chemical industry proper, the agricultural industry, employ materials for the manufacture of their divers products. If the question, therefore, is discussed which of the different products is likely to find the best market, it is essential to inquire always into the condition of those industries which are the principal consumers of the material in question. As the dyestuffs industry is just now very prominent, this industry may be used as an example.

Danger of Overestimating Consumptive Ability

Although the German dyestuffs industry dominated for many years the dyestuffs markets of the world, the German gas works have shown only a limited interest in the production of most of the more highly

developed by-products used by that industry. The reason was that the dyestuffs industry has developed a raw product industry of its own, buying from the gas works only the less advanced materials which were completed in the special factories of the large German dye works.

The situation seems to develop differently in this country. Several leading American gas plants have already taken up the production of by-products for the special purpose of the American dye industry, and they have gone much further in most instances than the German gas works. As a result the future of these gas works has been closely linked up with the prosperity of our dye industry, unless the chemical industry discovers additional uses for these products.

There is to-day the distinct danger that our gas works may overestimate the consumptive ability of the American dyestuffs industry for the by-products of the gas industry.

Gas works, therefore, considering the installation of by-products plants, would do well to study very closely the actual prospects of the American dyestuffs industry.

At present these are still exceptionally good. The industry has reached only the first stage of development, and it will still expand rapidly during the next few years.

Owing to the war the activities of the industry have been driven in a very one-sided direction. The most pressing needs of the textile and other dyestuff consuming industries had to be supplied, and little time, therefore, was given for research work for the development of the less important shades.

This work will now be taken up again, and it is certain to bring considerable results. With it there must follow a new expansion of the demand from the dyestuffs industry for intermediates and basic materials.

But this demand is bound to come to an end one day. The world's consumptive capacity for dyestuffs is limited. It is limited by the demand for textiles and such other materials requiring dyestuffs for their manufacture.

The chances, at present, are that the demand will grow very rapidly for the next few years, but that it will contract again after the reconstruction period, to settle down to a more normal development.

This latter should not proceed at a much faster rate than approximately 6 per cent increase in the total world consumption during every year.

The by-product industry cannot expect a larger increase in the demand for its products than that of the principal industry. The deduction for our gas works must be that they should not increase their facilities of producing by-products for the use of the dyestuff industry faster than the industry will be able to consume them.

Additional Industrial Uses for By-products

But this statement demands some qualification. There are additional industrial uses for these by-products which must be taken into consideration. Toluol, for instance, has a wide application in the manufacture of certain perfumes and in the making of certain medical drugs. Both branches of the industrial life of our nation are expanding, and with it must be found new uses for this particular product. With each addition in its application, therefore, grows the selling chance for its producers.

The product must be offered to the market at a cost which makes it competitive with the toluol produced by other works and also by many other industries which make it to-day as a by-product or are likely to produce it in future.

The war has shown that the by-product industry is one capable of very rapid development, which is the most dangerous aspect of it from the point of view of the medium and small producer. The large producer is able to readjust his organization much more easily to the market conditions than the medium and small producer.

For the latter a decline in the price of his product may mean financial ruin.

A point to be considered, therefore, is that of likely competition and its influence on the cost of the material.

This possibility is one of the most difficult factors to estimate, owing to the many outside influences bearing on it. The price of the by-product is not only governed by the cost of producing it and by its supply and demand, but it is largely influenced also by the cost and sales price of the primary product.

Where the By-product End Is Different with the Gas Works than with the Steel Works

For instance a steel works may be able to sell its gas by-products at a very low rate if it can make a large profit on steel, the cost of the by-product being in this case merely the actual expense for installing and operating the by-product plant. The gas industry is largely handicapped in this respect.

In normal times steel prices are the result of economic conditions. The steel industry is able to make use of a situation favorable to its product by raising the price of the steel and transferring in this way its whole earning effectiveness to the principal product. The by-product is in such a case actually nothing but a by-product which can be sold for any price it fetches. Every sale made above its cost of production is a clear profit on top of the total financial takings of the enterprise.

The production of gas as a commodity, however, is subject to the considerations of public policy. Its price is regulated by the rulings of official bodies often in a more or less arbitrary manner.

Public sentiment demands that the cost of the public utility should be kept inside certain limits, and it is extremely difficult to correct the effects of a rate ruling, how faulty it ever may be.

The by-product plant of a gas works, therefore, must be operated on a profit-bearing basis.

It may become in fact the only profitable branch of the gas plant's organization in times of high cost of materials and stationary rates.

A decline in the cost of the by-product, caused possibly by a very prosperous situation in the steel industry field, therefore, acts quite differently on the by-product business of the gas plant than it will act in the case of the by-product plants of the metallurgical industry. There is hardly any protection against this condition unless the public can be made to see that operating a gas works and a by-product

plant is not merely a supplementary means of increasing the profits of the gas works.

The Selection of a Suitable Product

The selection of a suitable product for supplementary manufacture, therefore, is a very complex problem, and it is questionable whether the more complicated forms of by-product manufacture are really very recommendable to the smaller gas works.

This raises the question whether under such circumstances the smaller plants should not rather abstain entirely from this means of adding to their income, or whether they can find some other means of making use of their present dormant earning potencies by turning the present waste to profitable uses.

This is a much more serious problem that we are wont to admit to ourselves just now.

The war has shown us that we have been running the industries of the nation on an extremely wasteful basis. Millions and millions of dollars have been lost to us every year by the old methods.

Considering the generally healthy situation of the economic life of the United States this state of things might have continued indefinitely, but for the war and the great change it has brought the whole world.

Industrial waste is now going to be eliminated from international industrial production, and this tendency will increase with the more complete understanding of the uses that may be made of all those materials which we have been inclined to regard in the past as waste materials.

Not only has the world learned that this waste has added enormously to the cost of manufacturing, but we have also suddenly realized that by wasting our industrial materials we are bound to approach much quicker that day when the existing resources of many of them will be completely exhausted.

Utilization of waste materials, therefore, will be a feature of the industrial activities of all the nations of the world, and the nation most apt in the conservation of its energies of labor and materials will be the one most fit to continue existence in the future.

Under these circumstances it is highly desirable that some use should also be made of the waste materials of our smaller gas works which in their totality must be of a considerable value.

Eliminating Waste in the Small Gas Plant

If the known by-product processes prove uneconomical for the small and medium gas plant, as may be likely, our engineers and chemists will have to evolve means by which a profitable use can be made of these products in a less costly and more direct manner.

The next step, therefore, in the development of our national waste and by-product industry should be the development of the respective sources of the medium and small gas works. The French gas works which have been faced by the same situation in recent years have already made extensive experiments in this respect which have led to an increasing employment of the gas water and residue for agricultural purposes.

The sale of gas water in uncondensed form naturally has much to recommend it from the gas works point of view. The water at the best is difficult to dispose of, if no condensing plant is available, and if a market could be found for it this particular form of waste might easily be made profitable to the smaller gas works. Experience shows that condensing the water for sale to chemical factories or for use in the by-product plants of the gas works is profitable only if a fairly large quantity of gas water has to be treated, which would make it impossible for the small and medium works to make use of the water for this purpose. If the gas water, therefore, can be sold in the immediate neighborhood as a fertilizer—for instance, this would be the best way of disposing of it.

Unfortunately there is a good deal against the use of the water for fertilizing purposes. The water is not free from poisonous materials which are dangerous to plant life, and experiments which have been made have shown conclusively that the application of the water to the plants directly may be actually detrimental to the further development of the plants.

On the other hand there remains the fact that side by side with these poisonous ingredients there are others which must be counted amongst our best-known fertilizing materials.

Two solutions have been proposed.

One would be to free the water of the poisonous materials by some cheap process that can be applied easily without complicated installation. The second is to confine the use of gas water as a fertilizer to the soil only before planting has taken place. This also might permit of the use of the water for fertilizing soil which is to be used for the purpose of dressing poor soil for future cultivation.

Agriculturists say that the beneficial value of the fertilizer will be greatly lost by filtration before the planting can take place.

This, however, seems to be a difficulty easily to be overcome by applying the water a few days before the planting only. No doubt, further experiments will be made in this direction, and our chemists might do well to give this question a little more attention in the future.

Too Important a Matter to Be Left to Chance

The preservation of the by-products of our gas works is too important a matter for its future development to be left to chance. As long as we can acquire many of our important industrial raw materials in the form of by-products there is no need of manufacturing them independently. Much money is saved in this way that can be employed to greater advantage in other forms of national production.

A good deal is talked just now about the co-ordination of national activities. There is no better form of co-ordination than turning the surplus products of one industry into the raw material for another.

Coal is one of our most important primary raw materials, and it is that which we have handled so far in the most wasteful manner. The by-product industry of the gas industry is just now busy eliminating at least part of this waste. All activities in this line, therefore, deserve the widest support of all those interested in its permanent prosperity.

Gas Machine Factors Involved in the Manufacture of Carbureted Water Gas

R. B. Harper Lists Fundamentals Upon Which Process Is Dependent and Offers Guidance Towards Locating the Cause of Variations in Results

Among various manufacturing processes, and particularly among those concerned in the production of artificial gas, there is probably none so complicated and subject to so many variable factors as that involved in the manufacture of carbureted water gas. Therefore, to anyone endeavoring to determine the true factors causing variations in the results observed in carbureted water-gas production, declared R. B. Harper in a paper presented before the recent annual convention of the Illinois Gas Association, the following question becomes a most natural one:

What Are the Factors Involved?

To answer the foregoing question is a far more difficult matter than is generally supposed, for a careful study reveals the fact that there are so many variable factors involved in the operation of a gas machine or concerned within its confines in the manufacture of a carbureted water gas which have different degrees of effect difficult to ascertain or estimate, it is hardly possible to simply attribute some particular end result to any one factor which at first thought may appear to be the cause. However difficult it may be to secure the proper answer, every effort should be made to study the complexities of carbureted water-gas generation in the most complete and systematic manner possible, for it is only by such means that one can ever hope to arrive at the true causes, to learn the extent of their various effects and to develop methods for controlling them so that desired results, as to the quality, volume of gas or other characteristics and factors involved in the production of carbureted water gas, may be attained with economy and reliability.

Fundamentals

Any attempt to list the different variable factors involved in the gas machine in the manufacture of carbureted water gas should be done with some regard for the general principles underlying the process of making the gas, and perhaps we could do not better than to roughly classify the factors according to the three chief fundamentals upon which the process of manufacture of carbureted water gas and other similar chemical processes are dependent.

These fundamentals are as follows:

Concentration.
Temperature.
Time.

They are subject to considerable variation, and hence all factors connected in one way or another with the foregoing fundamentals also change more or less and if not kept within reasonable limits may lead to undesirable results.

Concentration involves all factors which have to do with the amounts or quantities of the various elements, gases or materials available for entering into or resulting in the chemical reactions or physical changes involved in the production of carbureted water gas.

Temperature, the second fundamental, as all gas men know, is of prime importance, as the temperature of the generator fuel bed and of the checkerbrick has a very great influence on the volume and composition of the gases made.

The third fundamental is time, during which the various chemical reactions take place between the air and generator fuel while blasting, between the steam and hot generator fuel while producing blue water gas, and between the blue water gas and oil gas produced by the decomposition of gas oil by heat. Because of its importance in connection with the degree to which the chemical reactions progress, time also has a very great influence on the final volume and composition of the carbureted water gas made.

The Bonfire and Carbureted Water Gas in a Way Twins

The importance of these three fundamentals may be best appreciated by explaining how they are concerned with an ordinary bonfire, which, after all, has some of the same physical and chemical processes as those involved in the manufacture of carbureted water gas.

The fundamental of concentration is best illustrated by calling attention to the fact that when a very much larger surface readily available for burning action is exposed in the bonfire, as is the case when shavings, excelsior or thin splinters of wood instead of large blocks or logs are thrown on, there is a very great increase in the rate of burning, combustion or chemical action.

The effect of increased concentration is also noticeable when the air surrounding a bonfire changes from a calm to a strong wind, in which latter case, because there is more oxygen (the element in the air necessary for the combustion of the wood) reaching the burning surfaces per second, the bonfire burns with much greater rapidity and intensity.

We also see the effect of the fundamental of temperature in our simple illustration of a bonfire where, if the pieces of wood freshly thrown on the fire are not sufficiently heated, we find it is only with great difficulty that the surfaces of the wood become ignited and continue to burn; and we also know that at ordinary temperatures the wood will not burn, or, in other words, the oxygen of the air will not combine with the elements of the wood. However, it is common knowledge that after the wood has reached a sufficient temperature, combustion or chemical combination of the wood with the oxygen of the air readily takes place and proceeds with increasing rapidity as the temperature rises.

The fundamental of time may be noted in the chemical processes and products involved in a bonfire when we stop to consider the effects of time on the nature and rate of production of the products, such as smoke, half-burned wood, charcoal or simply ashes, produced by smoldering, smoky or almost smokeless, rapidly burning bonfires. In a smoldering fire a piece of wood may hardly be charred in five minutes and may take an hour to burn to ashes, whereas in five minutes' time under other conditions it may be burnt completely.

The variable fundamentals of concentration, temperature and time are of chief importance in chemical reactions or processes where the raw materials or elements entering into the reactions to form the various products are of simple, definite or uniform composition. However, in the manufacture of carbureted water gas, which is, on the other hand, very complex and subject to so many variable conditions, it becomes advantageous and practically necessary to consider in some detail the various individual factors which are more or less dependent upon concentration, temperature and time, and primarily affect the volume and composition of the make gas before it leaves a gas machine.

Tabulation of Variable Factors

In the following table an attempt has been made to list those individual, variable factors connected with the operation of a gas machine which investigation, research and practical experience have shown to be of importance in determining the initial factors of the rate of output, volume and composition of crude carbureted water gas leaving a gas machine.

The factors have been tabulated so as to roughly group them as to their relation to the fundamentals of concentration, temperature and time. Thus, those in groups C, D, E, F, G, H, I, J, K and L are more or less concerned with the question of concentration, while those in groups Q, R, S, T and U and in groups A, B, M, N, O and P are closely connected with the fundamentals of temperature and time, respectively.

It should be understood that the accompanying table lists factors some of which doubtless have but little effect upon the end results obtained, whereas others are given which investigation and ordinary observation or study have shown to have very important bearing on the various properties or characteristics of the products. Also it should be appreciated that since many of those factors not only vary from instant to instant but even at any one time are variable throughout the machine, a factor may be intended to represent only a general average condition. An example of this is the factor listed in group S as "No. 251. Temperature of Generator Fuel in Generator," by which is meant the general average temperature of all the generator fuel surfaces at any given time, since it does not appear to be possible or practicable to take into deep consideration the temperatures existing in the different parts of the fuel bed at any particular instant.

At first thought many of the factors may seem to be unnecessarily listed and of such minor importance as to be disregarded, but it is frequently the case that where something has an unknown degree of effect we only too often tend to disregard it entirely in our deductions and hence sometimes fall into serious error. Therefore, it is believed that since every one of the factors listed may have some independent effect, great or small, on the final results observed, they require some consideration and preferably investigation before they should be definitely disregarded as being of little importance. In this connection it should be said that what might be of minor importance in one case or condition may prove to be of major importance in another.

In any table in which the constituent factors are given in detail it is necessary to differentiate, and hence factors associated with the products of the oil have been separated from those originating and concerned with the generator fuel and similarly other factors have been listed separately because they have an independent effect and for the purpose of special consideration and analysis.

It might also be well to explain that by crude carbureted water gas is meant those tar-free constituents which are usually found at the inlet to the purifiers; by tar vapor and oil carbon output is meant those by-products which ultimately are more or less associated as water-gas tar; by blast gas is meant the mixture of all the various products leaving the purge cap or stack valve at any time; by the combustion products is meant the actual products resulting only from the combustion of producer gas, or other gases and carbon within the carbureter and superheater; by producer gas is meant the gas formed by forcing air through the generator fuel; by cinder or light ash is meant the light portions of the fuel or ash originally blown over from the generator to the carbureter; by clinker or heavy ash is meant the residual material left in the generator by the consumption of the generator fuel; by primary air is meant the air blown into the generator as the generator blast air; and finally, by secondary air is meant the air sent into the carbureter or superheater as carbureter or superheater blast air. The titles of the other factors, it is believed, are sufficiently self-explanatory to require no particular elucidation of the meaning.

With a list of the various factors before us, the first question which may naturally be asked is:

How Much Do These Factors Affect the Results?

To answer such a question in every detail is impossible with our present knowledge of the art of manufacturing carbureted water gas, for although we have investigated, experimented and studied results for a very long time we have always been hampered, in our attempts to seek the exact causes for the observed effects, by an infinite variety of combinations of variable factors which has defied us with more or less success and made our progress toward the truth a slow and arduous one.

It is extremely doubtful if there is any other process in so extensive use that has so many intricate and involved variable factors as has the carbureted water-gas process, and hence it is possible that we may never grasp all of the truths involved but must continually study the independent and combined effects of each and every factor with an ultimate object of perfect control of our product.

A book might be written upon the subject of the effects of the various gas-machine factors upon the results or upon other factors, but it is not possible

in this paper to do more than discuss a number of these effects in the hope that interest in the whole subject may be stimulated and possibly result in the collection of considerable new data and conclusions to be added to our present fund of knowledge concerning carbureted water-gas manufacture.

Table of Gas-Machine Factors Involved in the Manufacture of Carbureted Water Gas

A—Rates of Output

1. Rate of crude carbureted water-gas output from gas machine.
2. Rate of crude oil-gas output from gas machine.
3. Rate of tar, vapor and oil carbon output from gas machine.
4. Rate of crude blue water-gas output from gas machine.
5. Rate of excess steam output from gas machine.
6. Rate of undecomposed oil output from gas machine.
7. Rate of blast-gas output from gas machine.
8. Rate of combustion products output from gas machine.
9. Rate of producer-gas output from gas machine.
10. Rate of excess primary or secondary air output from gas machine.
11. Rate of cinder or light ash output from gas machine.
12. Rate of blue water-gas output from generator.
13. Rate of excess steam output from generator.
14. Rate of producer-gas output from generator.
15. Rate of excess primary air output from generator.
16. Rate of cinder or light ash output from generator.
17. Rate of clinker or heavy ash output from generator.
18. Rate of unconsumed generator fuel output from generator.
19. Rate of checkerbrick and deposit output from carbureter and superheater.
20. Rate of heat output or loss from external surfaces of gas machine.

B—Rates of Input

21. Rate of oil input to carbureter.
22. Rate of oil carbon deposit or input to carbureter and superheater.
23. Rate of secondary air input to carbureter and superheater.
24. Rate of cinder or light ash input or deposit in carbureter and superheater.
25. Rate of checkerbrick input to carbureter and superheater.
26. Rate of steam input to generator.
27. Rate of primary air input to generator.
28. Rate of generator fuel input to generator.

C—Amounts of Output

29. Amount of crude carbureted water-gas output from gas machine.
30. Amount of crude oil-gas output from gas machine.
31. Amount of tar vapor and oil carbon output from gas machine.
32. Amount of crude blue water-gas output from gas machine.
33. Amount of excess steam output from gas machine.
34. Amount of undecomposed oil output from gas machine.
35. Amount of blast-gas output from gas machine.
36. Amount of combustion products output from gas machine.
37. Amount of producer-gas output from gas machine.
38. Amount of excess primary or secondary air output from gas machine.
39. Amount of cinder or light ash output from gas machine.
40. Amount of blue water-gas output from generator.
41. Amount of excess steam output from generator.
42. Amount of producer-gas output from generator.
43. Amount of excess primary air output from generator.
44. Amount of cinder or ash output from generator.
45. Amount of clinker or heavy ash output from generator.
46. Amount of unconsumed generator fuel output from generator.
47. Amount of checkerbrick output from carbureter and superheater.
48. Amount of deposit output from carbureter and superheater.

D—Amounts of Input

49. Amount of oil input to carbureter.
50. Amount of oil carbon deposit or input to carbureter and superheater.
51. Amount of secondary air input to carbureter and superheater.
52. Amount of cinder or light ash input or deposit in carbureter and superheater.
53. Amount of checkerbrick input to carbureter and superheater.
54. Amount of steam input to generator.
55. Amount of primary air input to generator.
56. Amount of generator fuel input to generator.

E—Amounts Present at Any Given Time (Concentration)

57. Concentration of oil gas and oil vapors in carbureter and superheater.
58. Concentration of tar vapors and oil carbon in carbureter and superheater.
59. Concentration of oil carbon deposit in carbureter and superheater.
60. Concentration of blue water gas in carbureter and superheater.
61. Concentration of excess steam in carbureter and superheater.
62. Concentration of combustion products in carbureter and superheater.
63. Concentration of producer gas in carbureter and superheater.

64. Concentration of excess primary or secondary air in carbureter and superheater.
65. Concentration of cinder or light ash in carbureter and superheater.
66. Concentration of checkerbrick in carbureter and superheater.
67. Concentration of material composing the carbureter and superheater and connections.
68. Concentration of blue water gas in generator fuel in generator.
69. Concentration of steam in generator fuel in generator.
70. Concentration of blue water gas in clinker or heavy ash in generator.
71. Concentration of steam in clinker or heavy ash in generator.
72. Concentration of producer gas in generator fuel in generator.
73. Concentration of primary air in generator fuel in generator.
74. Concentration of producer gas in clinker or heavy ash in generator.
75. Concentration of primary air in clinker or heavy ash in generator.
76. Concentration of generator fuel in generator.
77. Concentration of clinker or heavy ash in generator.
78. Concentration of materials comprising generator and connections.

F—Intimacies of Contact

79. Intimacy of contact of oil vapors and resultant oil gas and tar vapor with checkerbrick and cinder, light ash or oil carbon deposits in carbureter and superheater.
80. Intimacy of contact of blue water gas and excess steam with oil vapors, oil gas and tar vapors in carbureter and superheater.
81. Intimacy of contact of blue water gas with checkerbrick and cinder, light ash or oil carbon deposits in carbureter and superheater.
82. Intimacy of contact of excess steam with checker brick and cinder, light ash or oil carbon deposits in carbureter and superheater.
83. Intimacy of contact of combustion products with checkerbrick and cinder, light ash or oil carbon deposits in carbureter and superheater.
84. Intimacy of contact of producer gas with checkerbrick and cinder, light ash or oil carbon deposits in carbureter and superheater.
85. Intimacy of contact of producer gas and excess primary air with secondary air in carbureter and superheater.
86. Intimacy of contact of excess primary and secondary air with checkerbrick and cinder, light ash or oil carbon deposits in carbureter and superheater.
87. Intimacy of contact of steam with generator fuel in generator.
88. Intimacy of contact of blue water gas with clinker or heavy ash in generator.
89. Intimacy of contact of steam with clinker or heavy ash in generator.
90. Intimacy of contact of primary air with generator fuel in generator.
91. Intimacy of contact of producer gas with clinker or heavy ash in generator.
92. Intimacy of contact of primary air with clinker or heavy ash in generator.

G—Free Spaces

93. Free space for gases and vapors in checkerbrick in carbureter and superheater.
94. Free space for gases and vapors above checkerbrick in carbureter.
95. Free space for gases and vapors in cinder, light ash or oil carbon deposit in carbureter and superheater.
96. Free space for gases and vapors in generator fuel in generator.
97. Free space for gases and vapors in clinker or heavy ash in the generator.
98. Free space above generator fuel in generator.

H—Surfaces

99. Surface of cinder, light ash or oil carbon deposit exposed to gases and vapors in carbureter and superheater.
100. Surface of checkerbrick exposed to gases and vapors in carbureter and superheater.
101. Surface of carbureter and superheater and connections internally exposed to gases and vapors.
102. Surface of carbureter and superheater and connections externally exposed to atmosphere.
103. Surface of generator fuel exposed to gases and vapors in generator.
104. Surface of clinker or heavy ash exposed to gases and vapors in generator.
105. Surface of generator and connections internally exposed to gases and vapors.
106. Surface of generator and connections externally exposed to gases and vapors.

I—Distributions

107. Distribution of oil gas and oil and tar vapors in carbureter and superheater.
108. Distribution of oil carbon in carbureter and superheater.
109. Distribution of blue water gas, and excess steam in carbureter and superheater.
110. Distribution of combustion products in carbureter and superheater.
111. Distribution of producer gas and excess primary air in carbureter and superheater.
112. Distribution of secondary air in carbureter and superheater.
113. Distribution of cinder and light ash deposit in carbureter and superheater.
114. Distribution of checkerbrick in carbureter and superheater.
115. Distribution of gas oil input into carbureter and superheater.
116. Distribution of secondary air input into carbureter and superheater.
117. Distribution of blue water gas and excess steam input into carbureter or output from generator.
118. Distribution of producer gas and excess primary air input into carbureter or output from generator.
119. Distribution of cinder or light ash input into carbureter or output from generator.

120. Distribtuion of blue water gas in generator fuel in generator.
121. Distribution of steam in generator fuel in generator.
122. Distribution of blue water gas in clinker or heavy ash in generator.
123. Distribution of steam in clinker or heavy ash in generator.
124. Distribution of producer gas in generator fuel fuel in generator.
125. Distribution of primary air in generator fuel in generator.
126. Distribution of producer gas in clinker or heavy ash in generator.
127. Distribution of primary air in clinker or heavy ash air in generator.
128. Distribution of generator fuel in generator.
129. Distribution of clinker or heavy ash in generator.
130. Distribution of generator fuel input into generator.
131. Distribution of steam input into generator.
132. Distribution of primary air input into generator.

J—Structures

133. Structure of cinder or light ash output from gas machine.
134. Structure of oil carbon deposit in carbureter and superheater.
135. Structure of cinder and light ash deposit in carbureter and superheater.
136. Structure of checkerbrick in carbureter and superheater.
137. Structure or design of carbureter and superheater and connections.
138. Structure of cinder or light ash input into carbureter or output from generator.
139. Structure of clinker or heavy ash output from generator.
140. Structure of unconsumed generator fuel output from generator.
141. Structure of generator fuel in generator.
142. Structure of clinker or heavy ash in generator
143. Structure of generator fuel input into generator.
144. Structure or design of generator and connections.

K—Compositions

145. Composition of crude carbureted water-gas output from gas machine.
146. Composition of crude oil-gas output from gas machine
147. Composition of tar and oil-carbon output from gas machine.
148. Composition of crude blue water-gas output from gas machine.
149. Composition of undecomposed oil output from gas machine.
150. Composition of blast-gas output from gas machine.
151. Composition of combustion products output from gas machine.
152. Composition of producer-gas output from gas machine.
153. Composition of cinder or light ash output from gas machine.
154. Composition of oil gas and oil vapors in carbureter and superheater.
155. Composition of tar vapors and oil carbon in carbureter and superheater.
156. Composition of blue water gas in carbureter and superheater.
157. Composition of combustion products in carbureter and superheater.
158. Composition of producer gas in carbureter and superheater.
159. Composition of cinder or light ash deposit in carbureter and superheater.
160. Composition of checkerbrick in carbureter and superheater.
161. Composition of materials composing carbureter and superheater and connections.
162. Composition of gas-oil input into carbureter.
163. Composition of blue water-gas input into carbureter or output from generator.
164. Composition of producer-gas input into carbureter or output from generator.
165. Composition of cinder or light ash input into carbureter or output from generator.
166. Composition of clinker or heavy ash output from generator.
167. Composition of unconsumed generator fuel output from generator.
168. Composition of blue water gas in generator fuel in generator.
169. Composition of producer gas in generator fuel in generator.
170. Composition of blue water gas in clinker or heavy ash in generator.
171. Composition of producer gas in clinker or heavy ash in generator.
172. Composition of generator fuel in generator.
173. Composition of clinker or heavy ash in generator.
174. Composition of primary or secondary air input into generator, carbureter or superheater.
175. Composition of materials composing generator and connections.
176. Composition of generator fuel input into gerator.

L—Pressures

177. Pressure of blast-gas output at top of superheater.
178. Pressure of carbureted water-gas output at top of superheater.
179. Pressure of oil vapors and oil gas in carbureter.
180. Pressure of blue water gas and excess steam in carbureter.
181. Pressure of secondary air input at inlet to carbureter or superheater.
182. Pressure of producer gas and excess primary air in carbureter.
183. Pressure of steam input at base of generator.
184. Pressure of primary air input at base of generator.

M—Times of Output

185. Time of crude carbureted water-gas output from gas machine.

(*Continued on page* 320.)

American Gas Engineering Journal

SIXTIETH YEAR

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As the Journal Views It

Prospects of Industrial Unrest

We are going through a trying period.

Industry has not readjusted itself; under existing conditions cannot.

People have not entirely been convinced, despite evidence offered, that there are not going to be any radical price lowerings for some time to come.

Construction has not boomed to the degree that the capital available and the necessities would seem to justify. There is still a temporary holding off.

Under these conditions, and the return to civil life of hundreds of thousands of men, the employment situation is grave in the extreme.

Yet there has been in this country no worth-while disorder or organized general violence.

This should be the answer to those harpies who hold over our heads the specter of Bolshevism and industrial unrest.

The population of the land is undergoing as severe a test as can possibly be given. Yet it maintains its balance and its characteristic American common sense.

Our present trials are but briefly transient. The artificial barriers that are holding back industry must soon break of their own weight. Then will come employment to a degree the supply cannot meet.

Because the population of this country can read and can reason, it knows this. It knows, too, that it has no basis for hatred toward capital.

It knows no one is more interested in seeing to it that the laborer gets his just hire, that he gets hours that will give him time for diversion between periods of work, that he has a home wherein to live that is suitable for decent living and the upbringing of healthy, intelligent children, than is capital, for capital has come to realize that in the welfare of its workers lies the stability of its investments.

And this realization on the part of capital is not merely an outcrop of the war, a cowardly scurrying before the European specter.

Capital was coming to this realization long before the war was ever thought of.

It was not forced upon it, but came gradually to it through the progressive increase in enlightenment, and broad understanding that mankind has attained, with interruptions, throughout all history. It would, of course, be absurd to contend that the tremendous times we have gone through, by stimulating men's mental activities, have not hastened it to fruition.

And labor knows that, given the will, capital alone has the comprehension of broad issues that can bring to labor those things labor rightfully desires without demoralization and without chaos.

Consequently, trusting capital to a degree it never trusted it before, labor in this country is, in the broad sense, content to wait while capital does its job for it.

The AMERICAN GAS ENGINEERING JOURNAL sees little reason to dread violent industrial unrest in the United States, and particularly in the gas field. The guarantee against it is the really intelligent and effective steps the various managements are taking to provide promptly for subordinates the mode of living they humanly desire, and beyond which they do not aspire to.

Milestones

Throughout the gas industry all men dimly sense it—the imminence of new times, greater times—a gas industry beside which the present gas industry would stand as a pigmy.

A recent issue of an industrial journal of national circulation carries a full-page coke advertisement in preferred space.

It is the advertisement of the Providence Gas Company seeking a market for a by-product—not a local market but a national market apparently.

This on the face of it is a novelty—a local gas company, not a holding company with plants in many territories, blazoning its name throughout the land.

But the true interest lies deeper.

It is a hint of the trend, a milestone on the way that leads to the gas industry of to-morrow—the greater gas industry, wherein the opportunities will be vast for those already versed in gas technique.

Who, then, can now be sluggard?

Where within our ranks is the man who can conscientiously feel that he has done enough when he has completed his day's work?

It is time for broadening, individually as well as collectively.

Nor can we gauge our fitness to reap the benefits, the advancements, the gas industry of the future must inevitably afford by measuring up to the standard of any of our present leaders.

Doubtless there are many who, given the opportunity, can just as competently manage a company quadrupled in scope as they manage their present company.

But while the opportunities will be greater in the gas industry of the future, so too will the responsibilities.

The ambitious young gas man of to-day may well fall short should he select from among our present leaders a standard to build up to; should he say, in effect: "I'll make myself as big and as broad as this man, who has demonstrated his competence to manage a gas company, and I'll then be fitted to manage one of the companies the future will bring forth."

Should he limit himself to such standard he is more apt, indeed, to manage one of the departments rather than head a company.

Emerson's advice still holds good: "Hitch your wagon to a star." Nothing less may suffice.

Is the Annual Bonus Worth the Money?

Any scheme of profit-sharing is designed primarily to better the lot of the workers. But the fact must be remembered that to be of maximum advantage to the employer it must serve as a stimulus to greater goodwill toward him and an impetus to more assiduous effort.

We have encountered a firm which does not believe in the annual bonus; takes the stand that employees regard the money received therefrom as an extra, sheer "velvet," and are consequently prone to get rid of it with less thought than they would squander the proceeds from their regular wage.

This is very true in fact. The small-wage man may be straining for new shoes for the children, but when the bonus comes it is more apt to provide them a transient diversion than go into something from which a relatively endurable benefit will be derived.

The first step in any scheme of compensation must be, of course, in all cases, an ample compensation that is regular and can be counted upon. After that, however, we would not want to be too superficial in condemning the annual bonus plan.

That the money when received is not generally utilized to the best advantage; that, dollar for dollar, it is not spent as wisely as the sums received from the regular compensation, does not demonstrate the plan to be unsound. It demonstrates, rather, a failure on the part of the employer to educate the employee to a proper viewpoint toward the money he receives through it.

Correspondence

Wherein Viewpoints Differ

Gentlemen: I dare say that in reading in type your editorial entitled "Somebody Overlooked" you have discovered, to your chagrin, that you have gotten yourselves into a hole. An entirely reasonable assumption of the casual reader is that the manufacturer whom you attack is not an advertiser in your columns. It will be equally reasonable for him to assume that if the manufacturer had been an advertiser in your paper the editorial would never have appeared.

The situation is at best a very unfortunate one for you. Aside from the question of ethics and honesty, you have evidently reckoned without your host. A somewhat longer experience in the gas field will demonstrate the significance of this statement.

Yours truly,

FENTON KELSEY.

EDITOR'S NOTE—It is quite evident from his letter that Mr. Kelsey's viewpoint as to what considerations should influence the editorial conduct of a gas journal and the viewpoint of the present editorship of the AMERICAN GAS ENGINEERING JOURNAL differ materially. Mr. Kelsey, as his letter reads, seems to say: "If it attracts advertising it is good; if it doesn't, and perhaps actually prevents a certain kind of advertising, it should be shied away from."

According to our viewpoint, there are some hundreds of subscribers paying us a full three dollars a year in the expectation that they will derive from the JOURNAL unbiased and unmercenary guidance, sound information that will enable them to become better and more efficient workers, an independent editorial conduct that will make for a better, a bigger gas industry, and for just treatment of the workers within its ranks, and will unhesitatingly condemn any suggestion or policy that will make a step backward or will lead to injustice to any man or woman within gas companies' organizations, or to any consumer connected with their lines.

When we started out to follow these policies, some three years ago, some people—not Mr. Kelsey, but others possibly cherishing similar viewpoints—told us it couldn't be done; wouldn't be tolerated. This, too, with gas company officials literally sitting up nights trying to devise means to get closer into the confidence of their public; striving to give better service, while they knew at the time rates, even for the service they were giving, were dishearteningly low; pondering means of improving the welfare of employees—palpably, in short, striving toward the same goal we have set: a bigger and better gas industry, and better and bigger opportunities for the worker within its ranks. And, in addition, gas men everywhere deploring the inadequacy, the supineness of their gas journals and holding before our eyes foreign gas journals as models of what others have accomplished.

We may reassure Mr. Kelsey in regard to the particular editorial he alludes to. We read it in cold type several times before our readers had the opportunity. We usually follow this course with all our editorials, except where the necessity of timeliness intervenes.

When it was written we did not inquire whether the manufacturer, or manufacturers, it hit was an advertiser in the JOURNAL or not. As a matter of fact, the only other letter we have received in regard to this editorial is *from an advertiser* who, to a degree, was hit by the merchandising curtailment but who answers his own question, as to whether he was the target aimed at, in the negative when he asserts his confidence that he has taken his medicine standing up, and has not whined for special consideration as a sop for the injustice done him.

The AMERICAN GAS ENGINEERING JOURNAL is not indifferent to its advertisers. It considers that they are straightforward business people with a useful and excellent product which they desire to bring to the attention of gas men in a position to purchase it.

The JOURNAL does not consider a policy of intolerance of sham and pleas for special consideration at all inharmonious with the best interests of its advertisers.

If the product cannot stand on its own feet, be sold on the basis of merit and quality exclusively, we are quite certain our advertisers would not want to sell it and the AMERICAN GAS ENGINEERING JOURNAL assuredly would not want to be a party to "putting something across."

An editorial policy that does not temporize with expediency, that is aimed to meet the legitimate expectations of its subscribers, in our viewpoint attracts subscribers of the type the reputable manufacturer with a meritorious product wants to reach. Because such a policy engenders a confidence in the statements made in such a publication on the part of the reader, an advertisement printed therein carries the advertiser's product before the market he seeks to reach in a most advantageous manner. The confidence engendered by the editorial contents carries over to a confidence in the statements made in advertisements.

A by-product of such an editorial policy is that it offers no attraction to the advertiser whose product lacks merit, therefore requires editorial boosting or special consideration to make its sale. Thus it effectually bars such advertisers out and justifies the confidence the reader reposes in those whose advertisements he encounters in such a publication.

Mr. Kelsey seeks a motive for our publishing such an editorial. He advances two assumptions which he authoritatively states are entirely reasonable. Perhaps to Mr. Kelsey's type of mind they are entirely reasonable. We would imagine they would also seem reasonable to the type represented in the combined advertising manager and editor. To us they do not seem at all reasonable. They seem to be presumed upon the "bring home the bacon" principle, which does not reckon overmuch as to the means by which the "bacon" is gotten.

But it is only fair to Mr. Kelsey to make clear to him the motive behind this editorial. Perhaps it may be a revelation to him as to how differently human minds may reason.

To the mind of the AMERICAN GAS ENGINEERING JOURNAL, appliances which are bought by gas companies and in turn placed in consumers' premises should be bought on a quality basis exclusively. They should not be bought because the gas company manager's grandfather's goat damaged the manufacturer's grandfather's garden, hence the company manager feels he owes something to the manufacturer. They should not be bought alone because the manufacturer is a lifelong friend. They should be bought solely and exclusively

because in the gas company manager's mind they represent the best quality available at the price it is practical to put them out.

Manufacturers selling to gas companies should be compelled, and the reputable have demonstrated they would want nothing better, to compete primarily on the basis of quality.

The editorial criticizes a tendency at least one manufacturer has manifested to want special consideration because he had confined himself entirely to the gas company market and when the gas companies stopped selling his sales outlet was stopped. No inference was conveyed that this manufacturer's product was not as meritorious as any available. The criticism was merely that he was seeking an advantage on an unsound premise that would inevitably react to the disadvantage of other manufacturers who, through other markets they themselves had developed, had not been knocked off their feet when one market failed.

In the second sentence of his last paragraph Mr. Kelsey seems to insinuate something disagreeable. Does Mr. Kelsey impugn the editorial honesty of the AMERICAN GAS ENGINEERING JOURNAL? If so, who is Mr. Kelsey? What are his antecedents?

These matters are important.

The AMERICAN GAS ENGINEERING JOURNAL has existed sixty years. It has been demonstrated that a fraud cannot be sold over a protracted period. And what the JOURNAL has sold has been exclusively information and guidance. Such can have no value to any buyer unless he can have confidence in the vender.

The matter of our own second-thought emotions on this editorial is of minor importance. For Mr. Kelsey's information, however, we might say we have not experienced that chagrin he alludes to, because we haven't yet detected the hole he assures us we have gotten ourselves into.

Gas Machine Factors Involved in the Manufacture of Carbureted Water Gas

(*Continued from page* 316.)

186. Time of crude-oil gas, tar vapor and oil-carbon output from gas machine.
187. Time of crude blue water gas and excess steam output from generator and gas machine.
188. Time of undecomposed oil output from gas machine.
189. Time of blast-gas output from gas machine.
190. Time of combustion products output from gas machine or secondary air input into carbureter or superheater.
191. Time of producer gas and cinder or light ash output from generator or gas machine.
192. Time of checkerbrick and deposit output from carbureter and superheater.
193. Time of clinker and heavy ash output from generator.
194. Time of unconsumed generator fuel output from generator.

N—TIMES OF CONTACT

195. Time of contact of oil gas, oil vapors and tar vapors with checkerbrick and deposits in carbureter and superheater.
196. Time of contact of blue water gas with checkerbrick and deposit in carbureter and superheater.
197. Time of contact of excess steam with checkerbrick and deposits in carbureter and superheater.
198. Time of contact of secondary air with gases, brick and deposit in carbureter and superheater.
199. Time of contact of producer gas with gases, brick and deposit in carbureter and superheater.
200. Time of contact of brick and deposits with gases and vapors in carbureter and superheater.
201. Time of contact of blue water gas with clinker or heavy ash in generator.
202. Time of contact of producer gas with clinker or heavy ash in generator.
203. Time of contact of steam with generator fuel in generator.
204. Time of contact of primary air with generator fuel in generator.
205. Time of contact of steam with clinker or heavy ash in generator.
206. Time of contact of primary air with clinker og heavy ash in generator.
207. Time of contact of generator fuel with gases and vapors in generator.

O—TIMES OF INPUT

208. Time of oil-carbon deposit or input to carbureter and superheater.
209. Time of gas-oil input into carbureter.
210. Time of cinder or light ash deposit or input to carbureter and superheater.
211. Time of checkerbrick input into carbureter and superheater .
212. Time of generator fuel input into generator.

P—TIMES

213. Time of gas machine down for repairing, relining or recheckering.
214. Time of gas machine idle, hot and with generator fire.
215. Time of gas machine idle and cold with no generator fire.
216. Time of up runs on gas machine.
217. Time of down runs on gas machine.

Q—TEMPERATURES OF OUTPUT

218. Temperature of crude carbureted water-gas output from gas machine.
219. Temperature of crude-oil gas, tar vapor and oil carbon output from gas machine.
220. Temperature of crude blue water gas and excess steam output from gas machine.
221. Temperature of blast-gas output from gas machine.
222. Temperature of combustion products output from gas machine.
223. Temperature of producer-gas output from gas machine.
224. Temperature of excess primary or secondary air output from gas machine.
225. Temperature of cinder or light ash output from gas machine.
226. Temperature of blue water gas and excess steam output from generator.
227. Temperature of producer gas and excess primary air output from generator.

228. Temperature of cinder or light ash output from generator.
229. Temperature of clinker or heavy ash output from generator.
230. Temperature of unconsumed generator fuel output from generator.

R—Temperatures of Input

231. Temperature of oil input into carbureter.
232. Temperature of primary air input into generator or secondary air input in carbureter and superheater.
233. Temperature of steam input into generator.
234. Temperature of generator fuel input into generator.

S—Temperatures at Any Given Time

235. Temperature of oil gas, oil vapors, tar vapors and oil carbon in carbureter and superheater.
236. Temperature of blue water gas and excess steam in carbureter and superheater.
237. Temperature of combustion products in carbureter and superheater.
238. Temperature of producer gas and excess primary air in carbureter and superheater.
239. Temperature of secondary air in carbureter and superheater.
240. Temperature of brick in carbureter and superheater.
241. Temperature of deposit on brick in carbureter and superheater.
242. Temperature of external surface of carbureter and superheater and connections.
243. Temperature of blue water gas in generator fuel in generator.
244. Temperature of producer gas in generator.
245. Temperature of blue water gas in clinker or heavy ash in generator.
246. Temperature of producer gas in clinker or heavy ash in generator.
247. Temperature of steam in generator fuel in generator.
248. Temperature of primary air in generator fuel in generator.
249. Temperature of steam in clinker or heavy ash in generator.
250. Temperature of primary air in clinker or heavy ash in generator.
251. Temperature of generator fuel in generator.
252. Temperature of clinker or heavy ash in generator.
253. Temperature of external surface of generator and connections.

T—Quantities of Heat Output or Absorbed

254. Quantity of heat in crude carbureted water-gas output from gas machine.
255. Quantity of heat in crude-oil gas, oil vapor, tar vapor and oil-carbon output from gas machine.
256. Quantity of heat in crude blue water-gas output from gas machine.
257. Quantity of heat in excess steam output from gas machine.
258. Quantity of heat in blast-gas output from gas machine.
259. Quantity of heat in combustion products output from gas machine.
260. Quantity of heat in producer-gas output from gas machine.
261. Quantity of heat in excess primary or secondary air output from gas machine.
262. Quantity of heat in cinders or light ash output from gas machine.
263. Quantity of heat in clinker or heavy ash output from gas machine.
264. Quantity of heat in unconsumed generator fuel output from gas machine.
265. Quantity of heat loss or output from external surface of gas machine.
266. Quantity of heat absorbed by decomposition of oil tar vapors, gases, etc., in carbureter and superheater.
267. Quantity of heat absorbed by action of steam with generator fuel, clinker, etc., gas machine.

U—Quantities of Heat Input or Generated

268. Quantity of heat in oil input into carbureter.
269. Quantity of heat in secondary air input into carbureter and superheater.
270. Quantity of heat in steam input into generator.
271. Quantity of heat in primary air input into generator.
272. Quantity of heat in generator fuel input into generator.
273. Quantity of heat generated by action of excess primary air and secondary air with gases, carbon, etc., in carbureter and superheater.
274. Quantity of heat generated by action of primary air on generator fuel clinker, etc., in generator.

V—Quantities of Heat at Any Given Time

275. Quantity of heat in oil gas, oil vapors, tar vapors and oil carbon in carbureter and superheater.
276. Quantity of heat in blue water gas and excess steam in carbureter and superheater.
277. Quantity of heat in combustion products in carbureter and superheater.
278. Quantity of heat in producer gas in carbureter and superheater.
279. Quantity of heat in excess primary air and secondary air in carbureter and superheater.
280. Quantity of heat in brick in carbureter and superheater.
281. Quantity of heat in deposit on brick in carbureter and superheater.
282. Quantity of heat in material composing carbureter and superheater and connections.
283. Quantity of heat in blue water gas in generator.
284. Quantity of heat in producer gas in generator.
285. Quantity of heat in steam in generator.
286. Quantity of heat in primary air in generator.
287. Quantity of heat in generator fuel in generator.
288. Quantity of heat in clinker or heavy ash in generator.
289. Quantity of heat in material composing generator and connections.

Among the various factors which might be discussed, "No. 1. Rate of Crude Carbureted Water-gas Output from Gas Machine," would probably be the first to attract the attention of an average gas man to whom the factor, expressed as gas made per month, per day or per machine, would be of prime interest. Upon study, he would find this factor, No. 1, to be composed of and directly dependent upon two other factors,

somewhat independent of each other, namely "No. 2. Rate of Crude Oil-gas Output from Gas Machine," and "No. 4. Rate of Crude Blue Water-gas Output from Gas Machine," and to be, of course, also dependent upon "No. 29. Amount of Crude Carbureted Water-gas Output from Gas Machine" and "No. 185. Time of Crude Carbureted Water-gas Output from Gas Machine." A much deeper analysis on his part would reveal the fact that the "Rate of Crude Carbureted Water-gas output from Gas Machine" is directly or indirectly dependent upon most of the other 288 factors which are listed in the table.

In a continuously operated plant, the element of time becomes very important and therefore the "Time of Crude Carbureted Water-gas Output from Gas Machine," upon which the rate of output of gas depends, is naturally curtailed as encroachments are made upon it by other factors such as "No. 189. Time of Blast-gas Output from Gas Machine" (blasting time); "No. 192. Time of Checkerbrick and Deposit Output from Carbureter and Superheater," and "No. 211. Time of Checkerbrick Input into Carbureter and Superheater" (recheckering time); "No. 193. Time of Clinker or Heavy Ash Output from Generator" (cleaning time), and "No. 212. Time of Generator Fuel Input into Generator" (charging time).

The effect of the factor No. 193, or cleaning time is considerable, as the following example will show:

Assuming we have two continuously operated gas machines exactly alike in every particular, and in one we have a high-grade coke which gives clinkers removable in one and one-half hours' total cleaning time each day, while in the other is used a fuel giving a difficult clinker requiring an hour longer to remove, the charging times for each machine being equal, naturally the remaining period of time in each twenty-four hours, available for making gas, is seriously encroached upon and reduced in the latter case by the increase in cleaning time as the following table will show:

Time with	Good Fuel	Poor Fuel
Charging time in hours per day...	2.0	2.0
Gas-making time in hours per day..	20.5	19.5
Cleaning time in hours per day...	1.5	2.5
Total hours per day.....	24.0	24.0

The loss of one hour in the possible gas making time in the above case means a known loss of about 5 per cent in daily gas make, due solely to the factor of cleaning time, namely, No. 193, or "Time of Clinker or Heavy Ash Output from Generator."

Further analysis would show that the factor No. 193, or "Time of Clinker and Heavy Ash Output from Generator" was directly dependent, for the magnitude of its effect upon the rate of output of gas, upon such factors as "No. 17. Rate of Clinker or Heavy Ash Output from Generator" (a factor probably dependent upon No. 144 or structure of the generator and also upon the quantity and quality of the labor employed); "No. 45. Amount of Clinker or Heavy Ash Output from Generator"; "No. 166. Composition of Clinker or Heavy Ash Output from Generator," and "No. 229. Temperature of Clinker or Heavy Ash Output from Generator," which latter factor, because of its connection with a possibly semi-fluid or pasty condition of the clinker, might greatly add to the time of cleaning.

The Factor No. 5, or "Rate of Excess Steam Output from Gas Machine," should be kept as low as is consistent with efficient operation, because for each 5 to 10 lb. of steam in excess of that really required per 1,000 cubic feet of gas made, there is a pound of boiler coal unnecessarily consumed and probably a much greater loss incurred by the effects of the presence of excess steam in the gas machine on the cracking of the oil, loss of heat and building up of pressure, all of which probably have detrimental actions upon the yield and quality of the products.

The "Rate of Oil Input to Carbureter," Factor No. 21, is well known as regards its general average effects upon the "Rate of Crude Oil-gas Output," and hence upon the "Rate of Crude Carbureted Water-gas Output from Gas Machine," it being the average practice to find about one per cent reduction in rate of carbureted water-gas output for each three to four per cent decrease in rate of oil input, its constant readjustment (to give a definite quality of gas) is necessitated by frequent variations in the other factors which are not so well known as their degrees of effect upon the end results. For example, as the conditions of the generator fuel bed or checkerbrick change, resulting in a greater or less production of blue water gas or decomposition of the gas oil, readjustments of the gas oil rate of input become necessary and sometimes rather difficult to make, in order to hold the composition of the output of carbureted water gas to the greatest possible degree of uniformity.

"Rate of Steam Input to Generator," namely Factor No. 26, is very important on end results as too little or too much steam means losses of various kinds. For any given condition of the generator fuel bed, there is some most efficient rate of input for the steam. For example, if 80 lb. of steam per minute is the most economical rate of input for a given set of conditions and for some reason this rate is increased to 100 lb. per minute, a reduction of about 50 deg. Fahr. might take place in the average temperature of the generator fuel bed, and on this account, the loss in Factor No. 12, or the "Rate of Blue Water-gas Output from Generator" may easily be as much as 20 per cent.

Factor No. 27, or "Rate of Primary Air Input to Generator" has a very considerable effect upon end results, due largely to its direct effect upon Factor No. 251, or the average "Temperature of Generator." It has been estimated that if we increase the rate of input of air to an ordinary 11-foot generator from 6,000 to 8,000 cubic feet per minute for a four-minute blasting or blow period, starting in each case with the average temperature of the fuel bed at, say, 2000 deg. Fahr., the rise in temperature is about 180 degrees in the first case and about 240 degrees in the latter. This means that on the average an increase yield of blue water gas of about 25 per cent or more might reasonably be expected.

All those who have had experience with asphaltic base gas oils having an unusual tendency to deposit carbon in the checkerbrick of a carbureter, appreciate the great effect of the Factor No. 50, the "Amount of Oil Carbon Deposit or Input to Carbureter and Superheater." This factor has been known to be so great in its effect as to practically plug the checkerbrick of a gas machine and hence reduce the make of gas almost to zero and often to a very inefficient rate of production.

The "Concentration of Generator Fuel in Generator,"

Factor No. 76, is of importance for, if the concentration, or, in other words, the depth of the fuel bed decreases too much, the quality and quantity of the blue water gas produced is seriously affected. Thus, where the average temperature of the fuel bed is, say, 2400 deg. Fahr., and all other conditions are the same except that in one case the depth of fuel bed is six feet while in the other case it is eight feet, the percentage of fixed gases produced may be almost in the same ratio; that is, when the concentration of generator fuel in generator is about 75 per cent of its original amount, it may result in the production of about 75 per cent as much blue water gas, which gas would also be of inferior quality due to its higher acid or CO_2 content.

The effect of Factor No. 79, or of the "Intimacy of Contact of Oil Vapors and Resultant Oil Gas and Tar Vapor with Checkerbrick and Cinder, Light Ash or Oil Carbon Deposits in Carbureter and Superheater," is worthy of attention, as investigation has shown that it has appreciable effect upon results. Expressing the intimacy of contact in terms of the ratio of the square feet of brick surface to the cubic feet of free space in the brick, a doubling of the ratio by spacing the checkerbrick closer has been found to decrease the efficiency of the utilization of the gas oil by over 5 per cent.

The "Distribution of Generator Fuel in Generator," or Factor No. 128, has an estimated effect upon the rate of production or output of blue water gas of possibly as much as a 10 per cent decrease, in cases where the generator fuel is so distributed as to be piled high in the center and two or three feet lower at the sides. With the generator fuel bed in good condition and of uniform depth, or distribution, the passage of air and steam through the "fire" is fairly uniform, whereas, in the condition described above, there is a natural tendency for the gases of poorer quality and in relatively greater volume to form in and rise through the outer edge of the fuel bed, making a so-called "mantle gas,"[1] than to pass upward through the center and thickest portion of the fuel bed to form a "central gas,"[1] and a final mixture of the two which is inferior to that obtained with an even full bed.

Factor No. 29, or the "Distribution of Clinker or Heavy Ash in the Generator" is dependent, among other things, upon the Factors Nos. 216 and 217, which are respectively, "Time of Up Runs on Gas Machine" and "Time of Down Runs on Gas Machine." These latter factors affect the distribution of the clinker which may, in some cases, be of the so-called side clinker or other type requiring considerable time for removal and hence possibly reducing the production of carbureted water gas to the extent of 5 per cent or more. Cases have been noted where the distribution of the clinker was such as to almost plug the generator completely and nearly prevent the passage of either steam or air.

The "Composition of Gas Oil Input into Carbureter" (listed as Factor No. 162), has been shown by investigations[2] to vary as much as 20 or 25 per cent in its effects upon the end results or various characteristics of the products produced in the manufacture of carbureted water gas. For example, 20 per cent more gallons of one gas oil than another may be required per 1,000 cubic feet of make gas of a given heating value.

The "Composition of Blue Water-gas Input in Carbureter and Superheater," or Factor 163, when varied within the limits of ordinary practice has been shown[3] to cause a variation of about 3 per cent in Factor No. 30, "Amount of Crude Oil-gas Output from Gas Machine," and of fully 20 per cent in Factor No. 31, "Amount of Tar Vapor and Oil Carbon Output from Gas Machine," or, namely, the tar output.

Factor No. 174, or the "Composition of Primary or Secondary Air Input into Generator, Carbureter or Superheater" is one which ordinarily is seldom considered, and yet it deserves attention owing to the variable content of water vapor comprising one of the constituents entering into the so-called composition of the primary or secondary air. The quantity of water vapor may easily vary from a normal average of less than .2 lb. per 1,000 cubic feet of air in winter to 1.6 lb. on a hot, humid day in summer, or even to 2.2 lb. per 1,000 cubic feet where considerable steam from a turbine or other source is allowed to enter the blower inlet along with the air. It has been estimated that the effect of an additional 2 lb. of steam or water vapor per 1,000 cubic feet of air has upon the temperature rise in a generator fuel bed being "blasted" or heated up from about 2000 deg. Fahr., is approximately equivalent to about a 15 per cent reduction; that is, the average temperature of the generator fuel might rise only 85 degrees instead of 100 in a given time when 2 lb. more of water vapor was present in the air used for blasting in the first case. In ordinary practice this might mean a reduction of nearly 15 per cent in the amount of blue water gas made.

"Composition of Generator Fuel Input into Generator," or Factor No. 176, is undoubtedly one of very great importance and far-reaching effect on the end results, which in this paper can only be briefly discussed. The composition of a generator fuel as regards its "fixed carbon" constituent gives an index of what maximum quantity of true blue water gas might be reasonably produced from a given quantity of the fuel. Thus, for example, a generator coke fuel with 80 per cent "fixed carbon" cannot be reasonably expected to contribute much more than 90 per cent as much actual blue water gas as another generator coke of about the same "volatile matter" content and about 90 per cent of the constituent known as "fixed carbon." If so radical a change be made in the composition of the generator fuel as to reach that of a soft coal, which for convenience we shall say contains about 50 per cent "fixed carbon," a reduction in the gas made per pound of general fuel may be as high as 40 per cent, although some slight advantage may be obtained, as regards the output of blue water gas, from the evolution of some of the "volatile matter" of the coal during the "run" or period of gas production.

A consideration of the composition of the generator fuel extends of course to the constituent known as "ash," which, by its excessive quantity or the unfavorable nature of its ingredients may be so bad in its tendency to form clinkers, very difficult or in some cases

1. "Variation Gas Phase in the Gas Generator," by K. Neumann, Chemical Abstracts, May 20, 1915.

2. "Some Fundamentals Affecting the Utilization of Gas Oil in Carbureted Water-gas Manufacture," by R. C. Downing, Illinois Gas Association Proceedings, March, 1916.

3. "Some Fundamentals Affecting the Utilization of Gas Oil in Carbureted Water-gas Manufacture," by R. C. Downing, Illinois Gas Association Proceedings, March, 1916.

almost impossible to remove, as to make it practically impossible to use the fuel with any degree of success or efficiency.

The Factor No. 178, of "Pressure of Carbureted Water-gas Output at Top of Superheater," might ordinarily be overlooked were it not for the fact that when it becomes excessive (due to a condition external to the gas machines proper)—(usually to high-pressure conditions existing in the main header or foul main to which two or more machines may be connected)—the amount of gas which may be produced per day is seriously reduced. The condition of excessive and detrimental pressure sometimes is due to conditions within the gas machine itself such as Factor No. 137, which has to do with the "Structure or Design of Carbureter and Superheater and Connections."

The "Time of Contact of Oil Gas, Oil Vapors and Tar Vapors with Checkerbrick and Deposits in Carbureter and Superheater," or Factor No. 195, is one of considerable importance on the end results. If the foregoing factor is three seconds in a given gas machine, and with other conditions practically constant, it increases to as much as four seconds, investigations have shown that there may be a decrease in gas-oil efficiency of nearly 5 per cent.

Factor No. 233, or the "Temperature of Steam Input into Generator," has been shown to have a very decided influence upon the volume of gas produced, increases as much as 25 per cent over that made by live steam having been recorded for superheater exhaust steam at temperatures about 150 deg. Fahr. higher than that for live steam.

The importance of the "Temperature of Brick in Carbureter and Superheater," listed in the table as Factor No. 240, has been recognized for some time as has been evidenced by the extensive use of pyrometers in the carbureters and superheaters of gas machines. A variation of 50 degrees in the temperature of checkerbrick, other factors remaining practically constant, may produce an average change of about 7 per cent in the amount of oil gas produced per gallon of gas oil used, and also the same percentage in the efficiency with which the gas oil is utilized for manufacturing a gas of a given quality. Such a degree of variation above a suitable average temperature may also mean a detrimental change in Factor No. 145, the "Composition of Crude Carbureted Water-gas Output from Gas Machine" as regards the naphthalene constituent which may thereby become so excessive as to form serious deposits in the works or elsewhere.

It appears that Factor No. 258, or the "Quantity of Heat in Blast-gas Output from Gas Machine" varies considerably and ranges as high as 20 per cent of all the heat involved in the process of making carbureted water-gas. Therefore, every effort should be made to hold it down to the lowest possible amount consistent with the efficient operation.

In the foregoing discussion, but a brief mention has been made of a few of the effects of the very many factors listed, and no attempt has been made to analyze the degree of some of the effects except in a very simple way. Time and space would not permit any other action being taken and in very many instances it must be confessed that the question, "How much do these factors affect the results?" must remain unanswered for the present.

It is believed and hoped that enough factors and their effects have been discussed to bring clearly before us the great necessity of studying these factors as never before, with the object of operating our gas machines to the greatest possible capacities and with the most efficient utilization of the raw materials, such as generator fuel and gas oil, in the production of carbureted water gas.

To secure the greatest capacity of a gas machine and the most efficient use of raw materials therein, we must be able to make the variable factors, which have been tabulated, act according to our will. We are therefore immediately confronted with the question as to

How Can We Control These Factors?

Any attempt to control variable factors, without seeking the true causes and degrees of their variations, is like groping in the dark for the solution of our difficulties with only a most remote possibility of success based upon guesswork and mere haphazard chance.

No true doctor attempts to diagnose his patient's ills without bringing to his aid all possible means of investigating and measuring the various conditions and activities of the patient's body, so that he may at least determine with the greatest possible chance of success, the real cause or causes of the patient's illness and then intelligently set about to correct it. What is true in the case of the ills of the human body is just as true of the ills of mechanical or chemical equipment, which requires more and more means of measuring their variable conditions and activities as the need for the normal and efficient operation of the equipment becomes more imperative.

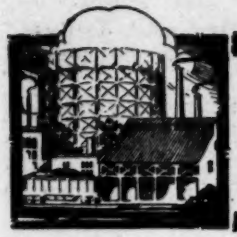
What is needed then is a study of the variable factors involved in the manufacture of carbureted water gas, for only through an ever-increasing addition to our present store of knowledge can we ever hope for the highest degree of efficiency in operation and use of gas oil and generator fuel.

True it is that in many works the amounts of input of gas oil, generator fuel, air and steam are measured and the temperature of the checkerbrick also measured and controlled, but these variables, while most essentially involved in proper control, really constitute but a small portion of those factors, concerning which some knowledge of their ranges of variation and other matters of vital interest is quite necessary if we are to attain the highest degree of efficiency.

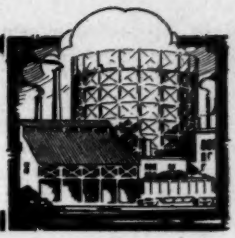
Measurement or means of observing the range and degree of variation of as many as possible of the most important factors is therefore the key to intelligent and proper control, so necessary for operating carbureted water-gas machines to their maximum capacities and efficiencies.

In conclusion, the writer regrets that, in the limited time at his disposal for the preparation of the paper, he was unable to present the subject matter in a more interesting manner and with less attention to seemingly dry and unimportant details. However, the subject is such that one must approach it in an analytical frame of mind and must delve with a view of unearthing most of the facts or factors and study them in detail as concerns their independent and also combined effects.

4. "Use of Exhaust Steam and its Possible Economies in a Small Water-gas Plant," by S. A. Reinhard and C. A. Schnerr, Illinois Gas Association Proceedings, 1915.



NEWS OF THE GAS INDUSTRY



East Ohio Company Granted Franchise for Dover

The Dover Council has granted the East Ohio Gas Company a franchise giving a rate of 45 to 60 cents for five years; city light plant to get rate of 30 cents.

Boston Consolidated Output for March

The Boston Consolidated Gas Company output in March totaled 551,690,000 cu. ft., a decrease of 37 per cent as compared to corresponding month of 1917.

Empire Companies Give $10,000 to Y. M. C. A.

The Empire Companies have given the Bartlesville, Okla., Y. M. C. A. $10,000, which completely wipes out the debt of the institution. The gift, which is symbolic of the company's plan to make every community in which it operates a better place to live in, will materially aid the Y. M. C. A. in providing other features for the young men of the city.

New Engineering Society Being Formed in Massachusetts

A new engineering society is being formed in Western Massachusetts, which will take in all branches of engineering. This association will be known as the Engineering Society of Western Massachusetts.

The following officers have been elected: Charles L. Newcomb, general manager Deane Works, Holyoke, president; C. C. Chesney, general manager General Electric Company, Pittsfield, vice-president; George E. Williamson, chief engineer Strathmore Paper Company, Springfield, vice-president; Winfield E. Holmes, treasurer Samuel M. Green Company, Springfield, secretary and treasurer. Directors for two years, Dr. Herbert C. Emerson, F. O. Wells, John C. Robinson. Directors for one year E. E. Lochridge, Samuel M. Green, Geo P. B. Alderman.

St. Louis Purchasing Office of Empire Company Closed

The St. Louis, Mo., office of the purchasing department of the Empire Gas & Electric Company has been closed. It was established last summer on account of the difficulty of obtaining materials. The need for an agent close to the factories was considered imperative. Since the end of the war, supplies are more easily procurable.

Henrico Gas Plant Offered to City at Cost

The Henrico County Gas Company, of Richmond, Va., recently offered the council committee on public buildings, properties and utilities its plant and mains in the northern suburbs, for their original cost price, approximately $264,000. At a previous meeting the company had asked the city to make an offer. While it was admitted that much of the pipe could not now be duplicated for what it cost before the war, the committee was not certain that the mains were of adequate size to meet the city's requirements, and requested Director of Utilities E. W. Trafford to find out the cost of an accurate survey of the property, so that the city might make its own valuation.

Receiver for Holland City Gas Company Offers Plant for Sale

The Grand Rapids (Mich.) Trust Company is advertising the Holland City Gas Company for sale to the highest bidder. The sale will be held Tuesday, April 22, in the office of the referee of bankruptcy. The property is a subsidiary of American Public Utilities Company and a possible purchaser is the City of Holland.

Mayor of Williamsport Welcomes Gas Men at Pennsylvania Gas Association Convention

Paper on Government Ownership and Operation of Utilities Read at First Day's Session

The eleventh annual convention of the Pennsylvania Gas Association was held at the Park Hotel, Williamsport, Pa., April 9, 10 and 11. The meeting was called to order by W. R. Rhoades, president, who introduced A. Hoagland, Mayor of Williamsport. Mayor Hoagland delivered an address of welcome, and stated that he had given up a trip out of town so as to be able to greet the members of the association.

C. E. Bartlett, of Philadelphia, Pa., responded, and said that he had noticed that wherever the association held their meetings the Mayor, chief of police and other officials always gave up any out-of-town trips planned at that time in order to be on the job while the gas men were in town, a compliment which the gas men appreciated.

After the reports of the different committees had been made and approved the president delivered the annual address.

The Pennsylvania Gas Association voted to affiliate with the American Gas Association, and a member for each of the working committees of the American Gas Association will be appointed later. The Pennsylvania association has a total of 131 members, and the following new members were elected at this meeting:

NEW ACTIVE MEMBERS

Edward B. Myers, United Gas Improvement Company, Philadelphia, Pa.; A. V. Vemmerman, engineer, Tyrone (Pa.) Gas Company; S. G. Kinter, general manager, Jersey Shore (Pa.) Gas Company; C. Miller, general manager; W. L. McCloy, superintendent; J.

A. Reed, assistant superintendent; J. H. Reed, Jr., purchasing agent; David Elder, superintendent-manager, and E. J. Stephany, industrial gas engineer, all of Philadelphia Company, Pittsburgh, Pa.; Carl A. Kuntz, Williamsport, Pa.

ASSOCIATE MEMBERS

F. S. La Chance, Pennsular Stove Company, Harrisburg, Pa.; H. T. Carkeek, J. B. Clow Sons, Philadelphia, Pa.; E. M. Stock, General Gas Stove Company, New York, N. Y.

Walter Clark, of Philadelphia, Pa., delivered a very interesting paper entitled "Government Ownership and Operation of Utilities."

A smoker and theater party took place Wednesday evening at 8 o'clock. The program for the balance of the meeting was as follows:

Thursday Morning, April 10, at 10 o'clock—Greetings from representative American Gas Association. Discussion: Topic, "Lighting Possibilities," W. A. Morris, Wilmington, Del. Paper, "The Gas Industry's Response to the Military Needs of the Country," Dr. Horace C. Porter, Philadelphia, Pa.

Thursday Evening, April 10, at 7 o'clock—Annual banquet at Williamsport Country Club house. Speakers: John G. Reading, of Williamsport, Pa., on "Reconstruction"; Major Griffin Gribbel, of Philadelphia, Pa., on "War Experiences."

Friday Morning, April 11, at 10 o'clock—A paper read on "Storeroom Operation and Mercandising," by A. M. Boyd, Reading, Pa. Discussion: "Industrial Relations," by J. B. Douglass, Philadelphia, Pa.; followed by short topics and discussions.

The following officers were elected for the ensuing year: President, George F. Speaker, Lebanon, Pa.; first vice-president, Oscar Heckert, York, Pa.; second vice-president, John L. Mather, Ardmore, Pa., and secretary and treasurer, L. R. Dutton, Jenkintown, Pa. Directors: E. E. Bair, Hanover, Pa.; H. H. Ganser, Norristown, Pa.; E. B. Meyers, Philadelphia, Pa., and Frank P. Duggan, Lewistown, Pa.

THE CENTRAL OHIO GAS COMPANY, Wooster, Ohio. $1,000; C. W. Sears, Ira L. Neely, Fenwick Ewing, R. A. Brooks and N. E. Shupe.

Increased Rates Allowed Oregon Company

An order was made by the public service commission allowing an increase in gas rates to the Oregon Gas & Electric Company effective Apr. 1. The company supplies gas for the towns of Roseburg, Grants Pass Medford, Phoenix, Talent and Ashland. After investigation, the commission arrived at the conclusion that the increase was necessary to prevent the company from shutting down because of financial stringency. The increase is above a former temporary advance granted by the commission July 1, 1918.

The new rates established follow: First 200 cu. ft. per month or less, $1.05; next 4,800 cu. ft., $2.10 per 1,000; all over 5,000 cu. ft., $1.75 per 1,000. A discount of 5 per cent will be allowed on all bills if paid within 10 days of the date of the bill.

The company made the contention that its receipts under the present rates are not sufficient to pay actual expenses of operation or interest on investment, bonds or other indebtedness.

"Testimony produced," says the order, "shows that the plants at these towns were built and ready for operation in 1912 at a time of great prosperity. A steady growth of the towns was expected, but, with just the reversal of this thing happening, it is now proved that the building of such substantial gas plants and distribution systems has been an unprofitable investment."

The commission says that the new rate will not give the utility a compensatory return, but will tend to alleviate a critical situation.

Increased Rate Allowed Stockton Company

The Western States Gas & Electric Company has been authorized to increase its rates for gas and electricity in the Stockton district, the California Railroad Commission, in an opinion written by Commissioner Frank R. Devlin and concurred in later by the other commissioners, having found that the rates fixed for gas last June and the electric rates fixed last November fail to yield a reasonable return to the company. This is due to added cost of oil and material, labor and taxes. The raise, however, is a small one, being in effect, so far as gas is concerned, but an increase of 5 cents a thousand over the rates consumers have been paying since last June. The decision to-day eliminated the surcharge of 10 per cent on gas allowed in the June decision, and effected the rate change by adding 15 cents to the base rate for each thousand cubic feet of gas. An increase of the minimum monthly charge from 50 cents to 75 cents is also allowed.

Increase Granted St. Louis County for Three Months to Be Continued

The increased gas rates granted to the St. Louis County Gas Company by the Missouri Public Service Commission from Dec. 31, 1918, to March 31, 1919, were continued indefinitely by order of the commission last week.

A hearing on the application of the gas company for extension of the higher rates was held at St. Louis recently by Commissioners E. J. Bean and Edward Flad. Consumers of various municipalities in St. Louis County opposed the application of the company.

The commission's order states that the commission is unable at this time to render a final decision, and that inasmuch as the protestants against the higher rate request more time in which to examine the evidence produced by the gas company the advanced schedule will remain effective until further notice.

Appeal Filed in Alton Rate Case

The Alton (Ill.) Gas & Electric Company has appealed to the Sangamon County Circuit Court at Springfield, Ill., the decision of the Illinois Public Utilities Commission which denied the company's application for increased rates for gas service.

The gas company requested authorization for a gross charge of $1.60 per 1,000 cu. ft. of gas. The commission last fall authorized such a rate pending a final decision in the case. After one hearing the commission denied the gas company the right to make the increase permanent. The gas company requested a rehearing. This was opposed by the municipal officials of Alton and by the Alton Board of Trade.

When the commission denied the petition for rehearing, an appeal from the action of the com-

mission was filed in the Circuit Court under the Illinois laws creating the public utilities commission.

Little Falls, Minn., May Have Gas Plant

A movement is on foot which may result in a gas plant being established in Little Falls, Minn. Hugh Glenn, representing the Public Improvement Company, which has its offices in the Metropolitan Bank Building in Minneapolis, is in Little Falls taking a survey of the city with the view of establishing a plant.

A rough estimate will be made of the cost of putting in a gas plant, after which the company will make a proposition to the city council if it is decided to establish a plant.

Kirksville Company Draws on Storage Capacity to Supply Gas for Meals After Fire

A recent fire at the plant of the Kirksville (Mo.) Gas, Heat & Electric Company, put the engine out of order, which hampered the company from supplying its consumers with gas.

The company, believing that the majority of its consumers should be considered, furnished gas for meals only by drawing on the storage capacity, which helped out a whole lot until temporary power was installed.

The company even took care of a hospital that had an operation to perform.

The JOURNAL is indebted to T. B. Anderson, manager of the company, for the foregoing information.

Twelve St. Louis Gas Men Receive Degree of Supervisor of Safety

Twelve men from the gas industry at St. Louis received the degree of supervisor of safety last week on their graduation from the school of safety engineers conducted at St. Louis by the Central Mississippi Valley division of the National Safety Council.

The course, which was the first of its kind offered anywhere in the country, included fourteen lectures on practically every phase of the prevention of industrial accidents. The men who represented the gas industry at the school and who received the degree were: Charles W. Albright, of the city lighting division, and the following men of the Laclede Gas Light Company: C. H. Stewart, assistant secretary; Herbert Schroeder, superintendent; E. H. Hofmeister, clerk; Frederick W. Frerichs, engineer; F. Allen Horr, assistant superintendent; R. L. Heade, foreman; Robert A. Crabb, attorney; C. J. Lueders, assistant superintendent; J. C. Pipkin, superintendent; J. Holterman, electrician, and J. H. Doarves, superintendent.

Ozark Gas Company Takes Over Maxine Properties

An agreement was reached recently by the Ozark Oil & Gas Company and the Maxine Oil & Gas Company, of Kansas, whereby the Ozark company will absorb the Maxine company.

The Maxine company is a $50,000 corporation, with producing properties in Kansas. It was organized a year ago by Kansas City men.

All the properties and stock of the Maxine company will be turned over to the Ozark company within the next thirty days.

In securing the properties of the Maxine company the Ozark company takes over 160 acres in the midst of the Labette County gas field, with two producing wells. This gives the Ozark company a solid block of 1,040 acres in the Labette gas pool, southeast of Mound Valley, Kan.

The Ozark company was organized in Springfield, Mo., in 1917, and recently moved its offices to the Keith & Perry Building, Kansas City.

National Petroleum Institute Formed to Carry on Work of Petroleum War Service Committee

At a recent meeting of representative oil men in New York, plans for a National Petroleum Institute were formulated. The final plans were worked out at a later meeting in Chicago of the American Petroleum League. Henry L. Doherty, as a member of the Petroleum War Service Committee, is an official of the Institute.

The chief aim of the organization is to carry on the work of the Petroleum War Service Committee which did such splendid work during the war. Another purpose is to continue the co-operation of the oil industry with the Government as well as to foster foreign and domestic trade in American petroleum products. Especial attention will be given to the study of the arts and sciences connected with the industry.

Thomas A. O'Donnell, who was in charge of oil production for the Fuel Administration, was elected president.

Gas Fuel Shows Its Advantages in the Art of Sherardizing

In the art of sherardizing war has made a number of changes. In one particular instance, copper dust with another alloy is used giving the material a copper effect and prolonging its life. Dry galvanizing means rust proofing of iron and steel but the process is used in some alloys. The depth of coating is regulated by the time and chemical treatment.

The operation of sherardizing begins with a preliminary cleaning of the material, executed by chemicals. The material or parts as they are called are then placed in retorts with the required amount of zinc dust. Then follows the heat treatment in a furnace with a range of temperature from 600 to 800 deg. Fahr. The zinc dust vaporizes in four to six hours. Great care is necessary in regulating the temperature. If it is allowed to go over 800 Fahr., the possibility of melting the zinc dust presents itself.

This delicate problem of heat control has been solved by the adaptation of gas as fuel. The installations made under the direction of engineers of the Public Service Company of Northern Illinois in the plants of customers on the company's mains, have proved completely successful, and thus have added another item to the achievements of gas. It facilitates the proposition of carrying through the sherardizing process with minimum waste, for with perfect control of the heat the danger of losses are greatly reduced and thus the zinc dust may be used a number of times.

The company's engineers recently completed plans of a 6 foot square furnace and this has been erected in the plant of a large customer. The function of the furnace is to heat

blanks out of which pressed steel car wheels are made. It replaces a similar furnace run on coal. The latter proving of insufficient capacity, the manufacturing concern planned the construction of larger quarters for the department.

This expense is avoided by the gas furnace. Gas under pressure is fed into it at the rate of 2,500 cu. ft. an hour. In practical operation it exhibits its superiority to the former soft soal furnace. More material is treated and work is lessened.

In numerous garages located in the territory of the Public Service Company gas has demonstrated its advantages and superior economy over acetylene and gasoline in blow pipe work. This is necessary to making repairs to batteries and other unit parts of automobiles. Gas for a variety of uses has been established for a considerable time in garages but its employment in the particular work mentioned is quite new.

Laclede Company Has Re-engaged 72 of Its Employees Discharged from the Service

The Laclede Gas Light Company of St. Louis already has re-engaged seventy-two of the men who left the company's service to answer the call of their country and who have obtained their discharge from military service. A special reception is being planned by the members of the commercial department of the company for Sergeant John J. Barada when he returns with the Twelfth Engineers, now in France.

United States Takes First Place in Exports to Brazil According to Statistics

That the United States took first place in the export of bitumen, coke, coal tar and gas oils to Brazil is indicated in statistics of Brazilian imports of these products which have just been received by Dr. Sebastio Sampaio, the Brazilian Consul at St. Louis, from the Brazilian Government.

These statistics show that in 1913 the United States exported 109 tons of bitumen including coal tar and gas oils, valued at $5,000, to Brazil while England exported 958 tons worth $37,000 in the same year. In 1917, however, the United States exported 436 tons of bitumen valued at $34,000, compared to 108 tons valued at $7,000 exported by England to Brazil that year.

The table also shows that in 1913 the United States exported no coke to Brazil, while England sold 14,000 tones valued at $176,000 to Brazil. In 1917 the United States sold 1,523 tons of coke to Brazil for $79,000, while in the same year England sold 185 tons for $6,000.

Order Requiring Alton Company to Reduce Rates and Make Refunds Temporarily Suspended

The Alton Gas & Electric Company of Alton, Ill., which recently appealed to the Circuit Court of Sangamon County the decision of the Illinois Public Utilities Commission ordering the gas company to resume a charge of $1.20 per 1,000 ft. of gas, and to refund to customers amounts deposited for meters, has scored a temporary victory. Judge E. S. Smith of the Circuit Court last week temporarily suspended the order of the State commission requiring the company to reduce its rates and make the refunds. A further hearing will be held before a final decision is rendered.

Personal Notes

E. H. Collins, manager of the Citizens Gas Company of Hannibal, Mo., has resigned that position to accept one with the Wisconsin-Minnesota Light & Power Company at La Crosse, Wis. Before going to La Crosse, Mr. Collins will visit his home in Marshall, Mich., where his father, Carroll Collins, is owner of the gas plant.

Nathan G. Nickerson, of Wollaston, has been elected a director of the Citizens Gas Light Company, Quincy, Mass., at a recent meeting of the board of directors.

W. J. Brown, formerly connected with the T. N. T. Works of the Du Pont Powder Company, has joined the forces of the Oklahoma Gas & Electric Company, Oklahoma City. He will act as business manager and power engineer. He will also have charge of this branch of the work for the entire State of Oklahoma.

Arthur A. Patten, who has been connected with the American Public Utilities Company for several years as complaint man, meter repairer and fitter, has assumed the position of sales agent of the Elkhart (Ind.) Gas & Fuel Company. Mr. Patten was born in Saginaw, Mich., about 27 years ago, where he gained his first experience in the gas business. Since then he has been at Manitowoc, Wis., Winona, Minn., and Holland, Mich.

Alfred J. Zimmerman, district manager at St. Louis for the Welsbach Street Lighting Company and E. Ross, local manager for the same company, have been elected to membership in the St. Louis Chamber of Commerce.

Charles C. Gardner, chief engineer of the Taunton (Mass.) Gas Light Company, has resigned his position at that plant, the resignation to take effect around the 15th of the month. Mr. Gardner, who has held that position for the past year or so, goes from the works to the Chandler Oilcloth plant as chief engineer.

W. L. Powers, formerly with the Decatur (Ill.) Railway & Light Company, is now with the Eclipse Gas Stove Company, Rockford, Ill. Mr. Powers has been in the gas business most of his life. He was in Eau Claire, Wis., for a time, and went from there to Dixon, then to Champaign. After that he went into business for himself. He spent one year with the Ruud Manufacturing Company.

The Massachusetts Gas Companies recently held the annual meeting of the stockholders at which the following five trustees were re-elected for a two-year term: Walter C. Baylies, Joseph B. Russell, Charles S. Davis, Samuel Carr and Charles F. Adams 2d.

Sergeant Roy Carpenter recently returned to Harvard, Ill., after several months' military camp service in Camp Sheridan, Georgia, receiving honorable discharge at Camp Grant. He resumed his work with the Western United Gas & Electric Company April 1.

Coalinga Considering Purchase of Gas Plant

As a result of a recent meeting Coalinga trustees are considering the purchase of the Coalinga (Cal.) Gas & Power Company for the approximate price of $40,000 with interest at 6 per cent, to be paid in eight yearly instalments from the earnings of the plant. R. C. Baker, representing the company, appeared before the board to make the proposal and showed a number of items of expense that would be cut by the city taking over the plant. He stated that negotiations are pending with one of the oil companies for a supply of natural gas in addition to that which is already being furnished, and that if the new supply is secured, there will be no necessity for manufacturing gas, which is extremely costly at the present high price of oil. If the supply is assured, the city could cut the gas rate in two and still have a good revenue over the annual payments.

Societies and Associations

THE EFFICIENCY CLUB, composed of employees of the Southern Counties Gas Company throughout Orange County, met in the Santa Ana office on Wednesday evening, Mar. 19, for their business and social meeting. Officers were elected and other business transacted. Forty-seven were present and enjoyed talks from four of the employees of the company who have been in the service, one having been in France. Refreshments were served at a long table where all were seated and a pleasant social time was enjoyed.

THE WOONSOCKET (R. I.) GAS & ELECTRIC EMPLOYEES' CLUB at its recent regular monthly meeting had the pleasure of hearing William Gould, commercial manager of the Massachusetts Lighting Companies of Boston, give an instructive and educational talk on "Salesmanship." Mr. Gould explained how salesmanship did not consist of merely selling goods for money, but how good fellowship, good-will, kind thoughts, etc., could be exchanged amongst employees of any company or any person by simply being careful and unselfish in daily work, thoughtful of the other fellow's welfare, and in so doing get the maximum enjoyment out of work while sowing seeds of content and happiness. He gave many interesting facts and told several clever stories to emphasize and prove the points he wanted to impress upon his audience.

Construction Notes

New Construction Under Way in Oakland

The Pacific Gas & Electric Company has begun the expenditure of $1,263,000 in the Oakland district, and about 1,000 men are at work erecting new buildings, increasing plant and extending gas mains and electric power lines. A portion of this work is at present under way, and the balance will be rushed as fast as material and labor will permit. The budget items of this great expenditure are as follows: No. 7 gas machine, now in course of construction at the foot of Grove Street, $175,000; steel frame building to house same, $25,000; auxiliaries, including boilers, compressors, pumps, etc., $201,000; new gas mains, including trunk lines to Berkeley, Richmond and San Leandro, $462,000; installation of boilers at main electric station to develop 2919 boiler horsepower, $150,000; new electric lines, $250,000.

Even in the midst of the war the company succeeded in getting permission from the Government to begin its new gas plant.

But nothing has been done toward extensions and replacements of gas mains or electric lines, or the increase of electric facilities. This part of the work is to begin at once.

The company is facing the supply of some 25,000 new consumers, of which about 15,000 are for gas and 10,000 for electricity. These figures include both home and industrial consumers. The figures of this company also show about 2,000 new homes constructed in Oakland in the last year and about 10,000 old buildings that have been fitted up and reoccupied.

The construction that is under way, that of the new unit for making gas, will give an increase of 6,000,000 cu. ft. a day, which will meet all the demands from the industries and will rectify some of the inequalities of gas pressure that have been experienced by householders during some parts of the day.

The new work, which is to be started at once, includes the rebuilding of the gas mains as far south as San Leandro and as far north as Richmond.

Chicago Company Awards Contract for Gas Tank

The contract for the first item of construction in connection with the $15,000,000 plant that is to be built by the Peoples Gas Light & Coke Company of Chicago was let last week. The contract was for a 10,000,000 cu. ft gas tank to be erected at Crawford Avenue and Thirty-sixth Street. It was awarded to the Bartlett Hayward Company of the Peoples Gas Building. The cost of this tank is estimated at $600,000.

Waco Company to Make Extensive Improvements

The Texas Power & Light Company will spend approximately $200,000 during the summer months in enlarging the capacity of the present artificial gas plant in Waco, Texas. The improvements contemplate a larger pipe line across the Brazos River and the addition of huge lifters and containers.

Southern Counties Company Extends Its Mains

With the purpose of increasing its service to the city of Chino and intermediate country, the Southern Counties Gas Company is making an extension of its mains between Pomona and Chino, the route being from East End Avenue down Riverside Drive, then south on First Street, to Chino Avenue. This will give Chino two main lines of gas supply, one being on Central Avenue, coming in from the north, and this line from the west.

The line is of three-inch welded pipe which is in forty-foot lengths, and therefore will be quickly laid. All told, there is about three miles in the new line.

Numerous connections will be made along the route and the new line will be connected with the Central Avenue line, while there will be a couple of tie-ins. The extension will give Chino a much more adequate supply of gas, as well as giving connection to a number who had never before had this advantage.

THE WESTERN STATES GAS & ELECTRIC COMPANY has declared the regular quarterly dividend or 1¾ per cent on the preferred, payable April 15, 1919, to stock of record March 31, 1919.

THE OKLAHOMA NATURAL GAS COMPANY'S earnings in February exceeded $600,000. This does not include earnings from gasoline. The figures are by far the largest in the history of the company for any month.

THE AMERICAN GAS & ELECTRIC COMPANY quarterly of 2½ per cent on common, payable April 1 and quarterly of 1½ per cent on preferred, payable May 1.

THE IMPERIAL VALLEY GAS COMPANY scored a net loss last year of $3,537, as appears from the annual statement of income, made public yesterday:

Operating revenue	$65,198.34
Operating expenses	57,535.39
Net operating revenue	$7,662.95
Non-operating revenue	1.00
Gross corporate income	$7,663.95
Non-operating revenue deductions	330.06
Interest accrued on funded debt	10,079.00
Other interest deductions	792.51
Total deductions	$11,201.57
Net corporate loss for year	5,537.62
Miscellaneous deductions from income	3,766.24
Deficit on Dec. 31, 1917	5,058.44
Deficit on Dec. 31, 1918	12,362.30

THE K. M. Z. OIL COMPANY, Wilmington, Del.—To acquire oil and gas lands and develop same; capital, $200,000.

THE LAWRENCE (MASS.) GAS COMPANY, incorporated under the laws of the State of Massachusetts, has filed with the Commissioner of Corporations, the following statement, dated Feb. 4, 1919:

ASSETS

	1919	1918
Real estate	$2,276,232	$2,215,522
Gas and electric equipment	2,032,265	2,002,442
Merchandise	454,895	217,279
Cash and debts receivable	315,085	333,465
Office fixtures	54,602	50,435
Garage	30,465	30,421
Liberty Bonds	21,750	12,559
Office buildings	50,118	50,118
Stocks	19,620	19,620
Prepaid items	63,295	47,846
Total	$5,318,327	$4,979,707

LIABILITIES

Capital stock	$2,500,000	$2,500,000
Accounts payable	1,162,734	791,637
Profit and loss	494,216	522,792
Bonds	300,000	300,000
Reserved for depreciation	823,351	833,328
Deposits	38,026	31,950
Total	$5,318,327	$4,979,707

THE GENERAL GAS & ELECTRIC COMPANY'S statement of net income of affiliated companies for the month of February, 1919, and comparison with the previous year is reported as follows:

System	1919	1918	Increase or Decrease
Rutland	$10,381	$4,926	$5,455
Northwestern Ohio	*2,991	*4,001	1,010
Sandusky	6,345	3,693	2,652
Sayre	2,093	1,866	227
Binghamton	7,085	6,656	429
New Jersey	5,515	3,715	1,800
Jersey corporation	*706	*733	27
Interurban Gas Co.	*76	*273	197
Total	$27,646	$15,849	$11,797

* Deficit.

THE VOLNEY GAS, OIL & REALTY CORPORATION, Syracuse, N. Y.—Petroleum production, etc.; capital, $100,000. Incorporators: R. H. Leggat, R. B. Parker, G. W. Ryan, Syracuse.

THE KEN-FLO OIL & GAS COMPANY, Lexington, Ky.; capital $100,000. Incorporators, George W. Wilder, Edward Gorey and Frank M. Bryson.

JOHN D. ORMROD, Pres. J. G. EBERLEIN, Sec'y & Treas.
EMAUS PIPE FOUNDRY
CAST IRON GAS & WATER PIPE
DONALDSON IRON CO. EMAUS, PA.
Manufacturers of CAST IRON PIPE AND SPECIAL CASTINGS FOR WATER AND GAS, also FLANGE PIPE and FITTINGS for same.

RUSSELL ENGINEERING COMPANY
SAINT LOUIS, MO.
Coal Gas Benches—Gas Works Apparatus
COMPLETE COAL CARBONIZATION PLANTS

PURIFYING MATERIAL, — BAGGED OR BULK
Manufacturers of GAS WORKS APPARATUS and EQUIPMENT
IRON SPONGE
Connelly Iron Sponge and Governor Co.
New York, Chicago
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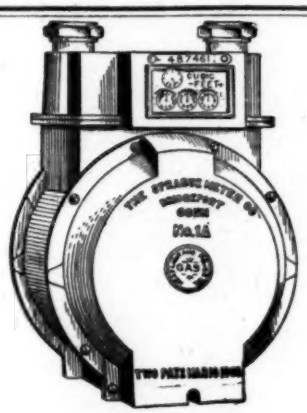

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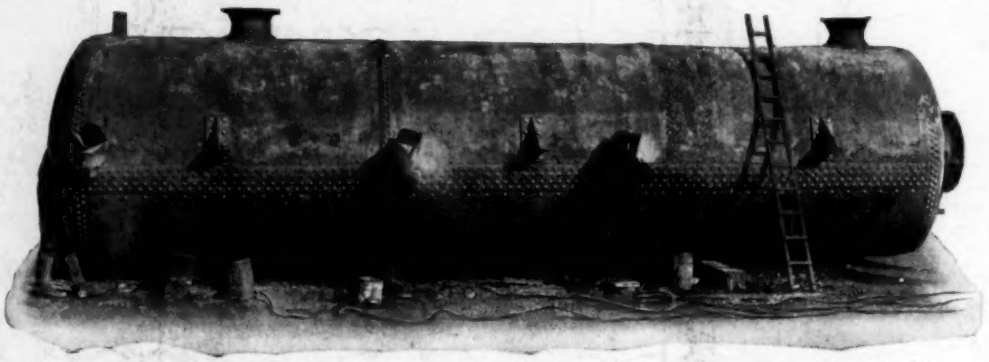
Welding Leaky Tanks



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The illustration above shows this method of repair being applied to a large tank of the Standard Oil Company.

The Wilson Welder is not only a ready repair tool in the case of leaky tanks, but will lastingly weld any metal of any bulk as successfully as it will steel or iron plate.

The great success of the Wilson Welder in making lasting welds on the nine-foot cast-iron cylinders of the German ships, and also in numberless other cases is due to the fact that the critical heat at which the metal should be fused is kept constant at the arc.

The predetermined, critical and constant heat eliminates the possibility of burnt metal or voids resulting in failure, common in welding when the critical heat cannot be controlled.

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